

A revision of *Eucalyptus* series *Callicolae* (Myrtaceae) from the south coast of Western Australia

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Abstract

Nicolle, D. A revision of *Eucalyptus* series *Callicolae* (Myrtaceae) from the south coast of Western Australia. *Nuytsia* 15(1): 69–76 (2002). *Eucalyptus* series *Callicolae* Brooker consists of four closely related taxa, two of which are newly described. *E. callicola* Brooker subsp. *callicola* is restricted to the Hamelin Bay area on the Leeuwin Coast, and subsp. *unita* Nicolle subsp. nov. occurs in scattered populations from west of Denmark eastwards towards Bremer Bay. *E. ligulata* Brooker subsp. *ligulata* occurs from Cape Le Grand to Cape Arid, and subsp. *stirlingica* Nicolle subsp. nov. is restricted to the Stirling Range. A key and distribution map for the taxa of *Eucalyptus* ser. *Callicolae* are presented.

Introduction

Brooker (1974) described six new species of *Eucalyptus* L'Her. subgenus *Eucalyptus* from southern Western Australia, including *E. callicola* and *E. ligulata*. At that time, *E. callicola* was known from only a single population and *E. ligulata* from two widely disjunct localities. Although the two species are regarded as closely related and more distantly related to other taxa of *E. subg. Eucalyptus*, it was not until recently (Brooker 2000) that the two were placed together in *E. series Callicolae*. Over the last 25 years, many more populations have been discovered that have been variously included in either of these two species and it has become apparent that some of these populations represent distinct taxa that are recognisable on morphological features and occupy non-overlapping geographical areas. This paper presents a taxonomic revision of *Eucalyptus* series *Callicolae*, including the description of two new subspecies.

Taxonomy

Eucalyptus* series *Callicolae Brooker, *Aust. Syst. Bot.* 13: 132 (2000). Type: *Eucalyptus callicola* Brooker.

The classification and distinguishing features of *E. ser. Callicolae* within *Eucalyptus* are as follows (amended from Brooker 2000).

Eucalyptus subg. *Eucalyptus* (the 'monocalypts') – cotyledons reniform; pith of branchlets lacking oil

glands; inflorescences simple, axillary; buds asepalous, uni-operculate.

Eucalyptus sect. *Longistylus* Brooker – all stamens fertile; style long.

Eucalyptus subsect. *Frutices* Brooker – mallees; juvenile leaves opposite; adult leaves concolorous; anthers ovoid, opening by non-confluent slits.

Eucalyptus ser. *Callicolae* – bark \pm smooth and annually decorticating; juvenile leaves sessile; inflorescences 7–19-flowered, held erect; buds ribbed; flowers white; seeds black.

A series of four closely related allopatric taxa distributed in coastal and subcoastal southern Western Australia (Figure 1).

Key to taxa of *Eucalyptus* ser. *Callicolae*

1. Adult leaves glossy, bright green; juvenile leaves highly glossy, light green; soil limestone-derived
 2. Fruit 12–16 mm diam., strongly ribbed, 4-locular **1a. *E. calcicola* subsp. *calcicola***
 2. Fruit 10–12 mm diam., smooth to weakly ribbed, 3(4)-locular .. **1b. *E. calcicola* subsp. *unita***
1. Adult leaves \pm glossy, blue-green; juvenile leaves dull to glossy, green to blue-green; soil granite or sandstone-derived
 3. Fruit disc descending to level, operculum conical, equal in length to hypanthium, pedicels 4–8 mm long **2a. *E. ligulata* subsp. *ligulata***
 3. Fruit disc level to ascending, operculum long conical, much longer than hypanthium, pedicels 2–3 mm long **2b. *E. ligulata* subsp. *stirlingica***

1. *Eucalyptus calcicola* Brooker, *Nuytsia* 1(4): 302 (1974). *Type*: near Cape Freycinet, 34°07'S, 115°00'E, Western Australia, 18 June 1971, K.M. Allan 634 (*holo*: PERTH; *iso*: AD, BRI, CANB, GAUBA, HO, K, MEL, NSW).

Distribution. Distributed in coastal sites from Cape Freycinet eastwards to near Bremer Bay.

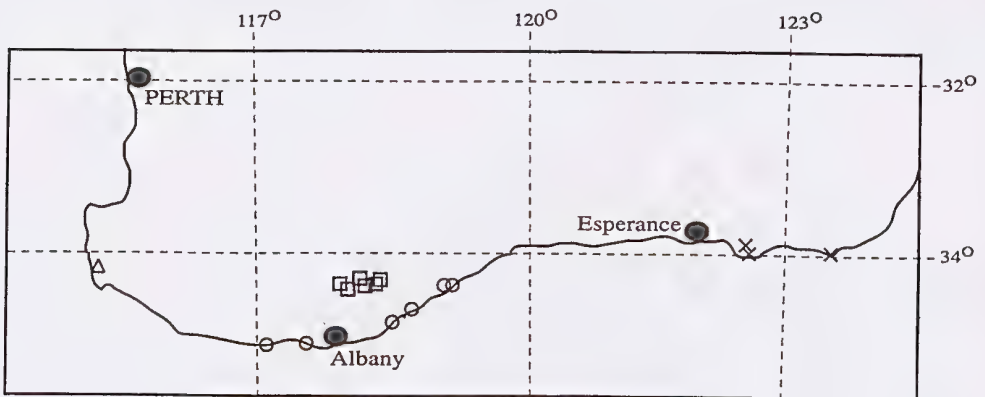


Figure 1. Map of the far southern part of Western Australia showing distribution of *Eucalyptus calcicola* subsp. *calcicola* △, *E. calcicola* subsp. *unita* ○, *E. ligulata* subsp. *ligulata* × and *E. ligulata* subsp. *stirlingica* □.

Notes. Two geographically separated subspecies can be recognised on the basis of adult morphology, differing primarily in flower bud and fruit size and ornamentation.

1a. *Eucalyptus calcicola* Brooker subsp. *calcicola*

Seedling and juvenile leaves glossy, bright green. *Adult leaves* lanceolate and \pm falcate, 60–110 mm long, 14–25 mm wide. *Inflorescences* 7–13-flowered. *Buds* strongly ribbed, 12–14 mm long, 7–8 mm wide; operculum conical, strongly ribbed. *Fruits* strongly ribbed, 12–14 mm long, 12–16 mm diam., 4-locular (4-valved). (Figure 2A)

Specimens examined. WESTERN AUSTRALIA: 23.2 km SW of Margaret River, 24 Sep. 1978, J.D. Briggs 297, 298 (CANB, PERTH); near Hamelin Bay, 8 May 1972, M.I.H. Brooker 3698 (CANB, PERTH); Boranup Beach Road, track to Rocky Point, 16 Nov. 1981, M.I.H. Brooker 7199 (CANB, PERTH); track W of Hooley Road, Boranup area, 24 Mar. 1983, M.I.H. Brooker 8054, 8055 (CANB, PERTH); halfway between Boranup and Cape Freycinet, 1971, W.H. Butler s.n. (CANB, PERTH); directly W of Boranup Karri Forest, Boranup, 30 Jan. 1973, P. Christensen 650 (PERTH); N side of Hooley Road, c. 1 km from beach, Leeuwin–Naturaliste National Park, 28 Nov. 1989, N. Gibson & M. Lyons 253 (PERTH); 25 km N of Augusta, 18 km S of Margaret River, 11.5 km W of Caves Rd on Hooley Rd, 9 Oct. 1984, S.D. Hopper 4295 (PERTH); near Boranup Hill, N of Hamelin Bay, 34°09'31"S, 115°02'27"E, 27 Jan. 1996, D. Nicolle 1674 & M. French (AD); Davies Rd to Quinns Rocks, Hamelin Bay, 22 May 1982, C.J. Robinson 4799 (PERTH).

Distribution and habitat. Known from a few stands between Cape Freycinet and Cape Hamelin, growing on large coastal dunes of shallow sand over limestone. *E. calcicola* subsp. *calcicola* is sometimes associated with *E. megacarpa*, with a putative hybrid between the two taxa known (M.W. McDonald 1317, CANB).

Conservation status. Conservation Codes for Western Australian Flora: Priority Four. Although *E. calcicola* subsp. *calcicola* is of very restricted distribution, all populations are conserved within Leeuwin–Naturaliste National Park and is considered secure.

Notes. With the description of subsp. *unita* below, the typical subspecies of *E. calcicola* is now restricted to the Leeuwin coast. *E. calcicola* subsp. *calcicola* has larger, more prominently ribbed buds and fruits than the other taxa in the series and has some horticultural potential in difficult, coastal situations on limestone.

1b. *Eucalyptus calcicola* subsp. *unita* Nicolle, subsp. nov.

Affinis *Eucalypto ligulatae* sed characteribus sequentibus distinguitur: foliis juvenilibus nitidibus, viridibus; foliis adultis nitidibus, viridibus; operculis brevioribus, minus conicis; habitatione calcareo differt. Affinis subspecie typica characteribus sequentibus distinguitur: alabastris minoribus, minus costatis, operculis rotundatis vel conicis, fructibus minoribus, laevibus vel leviter costatis, plerumque 3-locularibus differt.

Typus: Point Hillier, WSW of Denmark, 35°04'S, 117°09'E, Western Australia, 28 January 2001, D. Nicolle 3757 & M. French (holo: PERTH; iso: AD, CANB, MEL, NSW).

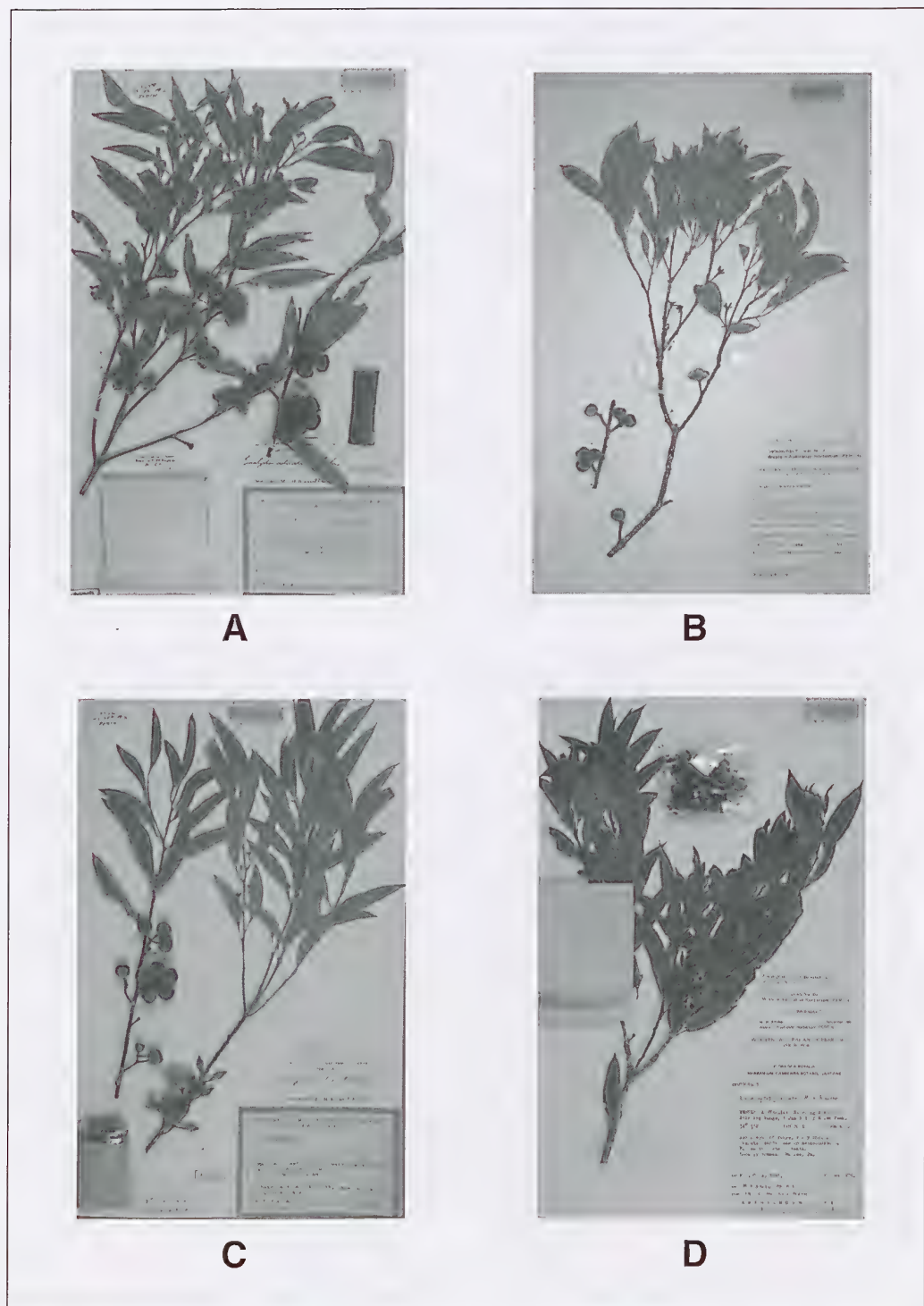


Figure 2. Holotypes. A – *Eucalyptus calcicola* subsp. *calcicola*; B – *E. calcicola* subsp. *unita*; C – *E. ligulata* subsp. *ligulata*; D – *E. ligulata* subsp. *stirlingica*.

Mallee, 1–8 m tall, crown dense. *Lignotuber* present. *Bark* smooth throughout, \pm dull, grey over light grey, tan or slightly green-yellow, decorticating in strips. *Branchlets* not glaucous, pith glands absent. *Cotyledons* reniform. *Seedling leaves* opposite, sessile, ovate, discolorous, glossy above, bright green, to 50 mm long and 30 mm wide; seedling stems terete, smooth or sparingly hairy. *Adult leaves* disjunct, petiolate, lanceolate to broad-lanceolate and often \pm falcate, 45–115 mm long, 12–25 mm wide, concolorous, glossy, light green or yellow-green, reticulation broken, oil glands apparently absent. *Inflorescences* axillary, singular, 7–13(19)-flowered, peduncles 7–15 mm long, pedicels 3–5 mm long. *Buds* 8–11 mm long, 5–7 mm wide, operculum weakly ribbed, flattened-hemispherical to conical, 4–5 mm long. *Flowers* white. *Fruit* cupular to truncate-globose, smooth to weakly ribbed, 9–11 mm long, 10–12 mm wide; operculum scar slightly ascending, to 1 mm wide; disc more or less level, 1–2.5 mm wide, valves 3, rarely 4, enclosed. *Seeds* boat-shaped, glossy, dark brown to black, 2–3 mm long, slightly flanged, ventral side \pm smooth, dorsal side finely reticulate. (Figure 2B)

Specimens examined. WESTERN AUSTRALIA: 800 m W of lookout along walk trail, 20 m N of track, West Cape Howe National Park, 19 Feb. 1993, A. Annels 3138 (PERTH); 1.9 km from Bremer Bay road on track 11.7 km W of Swamp road, 9 March 1988, M.I.H. Brooker 9921 (PERTH); N of Warramurrup Hill, 9 Mar. 1988, M.I.H. Brooker 9922 (PERTH); West Cape Howe, on ridge, c. 500 m W of lookout, 29 Oct. 1988, L. Johnson 9149 (AD, BRI, CANB, NSW, PERTH); West Cape Howe, Bruce Tarbottom Memorial Walk, on ridge crest, 5 Sep. 1988, K. Hill 3076 (AD, CANB, MEL, NSW, PERTH); 1.8 km S of Bremer Bay Rd on Reef Beach Rd [actually Warramurrup Rd], 6 Oct. 1984, S.D. Hopper 4234 (PERTH); Shelly Beach, West Cape Howe, hill above beach, 29 Dec. 1986, G.J. Keighery 10001 (PERTH); Pallinup River Estuary, 5 Aug. 1971, A. Kessell 961 (PERTH); “Barry’s place”, near Hauloff Rocks, 8 Oct. 1996, D. Nicolle 1878 (CANB, PERTH); 4.1 km N of West Cape Howe, 28 Jan. 1988, A. Napier & A. Taylor 212, 213, 214 (CANB, NSW, PERTH); Cape Riche, no date, K.R. Newbey (PERTH); 3 miles [5 km] NW of Hauloff Rock, 50 miles [80 km] NE of Albany, 29 Jan. 1973, K.R. Newbey s.n. (PERTH); West Cape Howe National Park, 35°06’22”S, 117°37’51”E, 27 Jan. 1996, D. Nicolle 1669 (AD, CANB, PERTH); near Warriup Hill 34°42’14”S, 118°33’19”E, 27 Jan. 2001, D. Nicolle 3753 & M. French (AD, CANB, PERTH); Point Hillier, WSW of Denmark, 35°03’43”S, 117°09’09”E, 28 Jan. 2001, D. Nicolle 3758 & M. French (AD, CANB, NSW, PERTH); 1.8 km from Bremer Bay Rd on Warramurrup Rd, 34°24’50”S, 119°10’08”E, 21 July 2001, D. Nicolle 3978 & M. French (CANB, PERTH); 11.1 km from Bremer Bay Rd on Warramurrup Rd, 34°27’59”S, 119°08’50”E, 21 July 2001, D. Nicolle 3979, 3980 & M. French (CANB, PERTH); West Cape Howe National park, walk track ridge line near summit from Shelley Beach, 21 Dec. 1992, C.J. Robinson 1067 (PERTH); Hauloff Rock area, Cape Riche, 7 Feb. 1991, C.J. Robinson & L. Anderson s.n. (ALB, PERTH); near southern tip of Cape (Point) Hillier, west end of William Bay, west of Denmark, 35°03’40”S, 117°08’50”E, 22 Apr. 1989, A. Syme 89-1 & 89-2, S.G. Webster & A.S. Weston (PERTH).

Distribution and habitat. *Eucalyptus callicola* subsp. *unita* is known from scattered populations from Point Hillier, west-south-west of Denmark, to Warramurrup Hill, west of Bremer Bay. All populations occur on coastal headlands or large limestone dunes. Soils are grey sandy loams or sand overlying limestone. It occurs as an emergent in dense, low coastal shrubland, often dominated by *Agonis flexuosa* and *Acacia*, *Melaleuca* and *Dryandra* species. It sometimes occurs with other scattered mallee species such as *Eucalyptus grossifolia* sens. lat., *E. x missilis*, *E. decipiens* subsp. *adesmophloia*, *E. pleurocarpa* and *E. goniantha* subsp. *notactites*.

Conservation status. Conservation Codes for Western Australian Flora: Priority Four. Populations are scattered and variable in size. All known populations consist of less than several hundred individuals, except the populations near Hauloff Rocks and at Warramurrup Hill, where the populations are much larger, although not accurately surveyed. The subspecies is conserved in West Cape Howe National Park.

Etymology. From the Latin *unitus* (join together) referring to this species linking *E. calcicola* subsp. *calcicola* and *E. ligulata*, both geographically and morphologically.

Notes. This taxon has previously been known as *Eucalyptus* sp. West Cape Howe (G.J. Keighery 10001), *E. telenotia* Nicolle ms. and *E. unita* Nicolle ms. It is distinguished from *Eucalyptus calcicola* subsp. *calcicola* by the smaller, less ribbed buds often with a rounded to conical operculum and the smaller, smooth to weakly ribbed, usually 3-locular fruits.

Eucalyptus calcicola subsp. *unita* has previously been confused with *E. ligulata* (Brooker 1974; Brooker & Kleinig 1990; Kelly *et al.* 1990), because its relatively small, shallowly ribbed buds and fruits somewhat resemble those of *E. ligulata*. The glossy, light green juvenile and adult leaves, and limestone habitat of *E. calcicola* subsp. *unita* distinguish it from *E. ligulata* and indicate a closer relationship to *E. calcicola* subsp. *calcicola*. Briggs & Leigh (1995) included this taxon (populations from West Cape Howe) in both *E. calcicola* and as an unnamed species (*Eucalyptus* sp. 54).

Populations from west of Albany consistently possess a flattened-hemispherical operculum, while most specimens collected east of Albany have a conical operculum. At Warramurrup Hill (near Bremer Bay), individuals with opercula varying in shape from hemispherical to conical can be found.

2. *Eucalyptus ligulata* Brooker, *Nuytsia* 1(4): 300 (1974). *Type:* about 1.5 miles [2.4 km] east of the beach near Cape Le Grand, 33°58'S, 122°90[sic]'E, Western Australia, 15 March 1972, K.M. Allan 820 (*holo:* PERTH; *iso:* FRI, K, NSW).

Distribution. Distributed north of Albany in the Stirling Range and east of Esperance, at Cape Le Grand and Cape Arid.

Notes. Two geographically separated subspecies can be recognised on the basis of adult morphology, differing primarily in the adult leaf, flower buds and fruit size, flower bud structure and orientation of the fruit disc.

2a. *Eucalyptus ligulata* Brooker subsp. *ligulata*

Adult leaves 60–75 mm long, 14–16 mm wide. *Peduncles* 10–17 mm long. *Pedicels* 4–8 mm long. *Buds* 10–14 mm long, 4–5 mm diam.; operculum conical, smooth to very slightly ribbed, 5–7 mm long. *Fruit* pyriform-ovoid to barrel-shaped, smooth to weakly ribbed, 10–14 mm long, 9–13 mm wide; operculum scar ascending, < 1 mm wide, disc level to descending, 1–2.5 mm wide, valves 3. (Figure 2C)

WESTERN AUSTRALIA: near Cape Le Grand Bay, Cape Le Grand National Park, 15 March 1972, K.M. Allan 822 (CANB, PERTH); S of Frenchmans Peak, Cape Le Grand National Park, 22 June 1978, D.F. Blaxell 1682 (PERTH); Lucky Bay, Cape Le Grand National Park, 22 June 1978, D.F. Blaxell 1683 (PERTH); Lucky Bay, Cape Le Grand National Park, 6 Nov. 1987, D.F. Blaxell 86 & M.I.H. Brooker (PERTH); 2nd creek E of granite dome which is about 1 mile [1.6 km] from Cape Le Grand towards Esperance, 22 April 1972, M.I.H. Brooker 3609, 3610 (CANB, PERTH); W side of main entrance to Lucky Bay, 8 April 1974, M.I.H. Brooker 4474, 4475 (CANB, PERTH); foot of E side of Frenchmans Peak, near Cape Le Grand, 8 April 1974, M.I.H. Brooker 4476 (CANB, PERTH); Lucky Bay, 21 Jan. 1966, A.S. George 7478 (PERTH); Cape Le Grand National Park, c.1 km NE of Mt

Le Grand, 3 May 1982, *S.D. Hopper* 2274 (PERTH); Mt Arid, track to Thomas Fishery, Cape Arid, 17 June 1985, *G.J. Keighery* 7641 (PERTH); Mt Arid, Cape Arid, 30 Oct. 1989, *G.J. Keighery* 10875 (PERTH); western end of Thistle Cove, 15 Nov. 1987, *A. Napier* 156 (PERTH); 200 m S of waterfall N of Mt Le Grand, 33°49'15"S, 122°12'21"E, 8 Dec. 1992, *D. Nicolle* 175 (AD); E slope of Mt Arid, in saddle between summit and large dome to SE, 23 Nov. 1985, *A. Rodd* 5138 (PERTH); W end of Lucky Bay, Cape Le Grand National Park, 22 June 1967, *R.D. Royce* 8388 (PERTH); at N base of Mt Le Grand c. 200 m E of upper check dam, Cape Le Grand National Park, 5 Nov. 1971, *A.S. Weston* 7030 (CANB, PERTH); E of Lake, below Frenchmans Peak, Cape Le Grand National Park, 27 Nov. 1973, *A.S. Weston* 8964 (PERTH); Lucky Bay, near Cape Le Grand, 17 Jan. 1944, *H.M. Wilson* 76 (PERTH).

Distribution and habitat. Distributed east of Esperance where it is known from two disjunct localities, viz. Cape Le Grand and Cape Arid. It occurs on sands overlying granite near large coastal granite domes and peaks. Associated eucalypt species include *E. aquilina*, *E. doratoxylon*, *E. incrassata*, *E. lehmannii*, and *E. semiglobosa*.

Conservation status. Conservation Codes for Western Australian Flora: Priority Four. All known populations are conserved within Cape Le Grand and Cape Arid National Parks. The subspecies is considered to be rare but not currently threatened.

2b. *Eucalyptus ligulata* subsp. *stirlingica* Nicolle, subsp. nov.

A subspecies typica pedicellis brevioribus, alabastris angustioribus, operculis longis, conicis, aliquando quam hypanthio multo longioribus; fructus disco planato vel elevato differt.

Typus: Stirling Range, 1.2 km north-north-east of Ellen Peak, Western Australia, 19 January 1979, *M.D. Crisp* 5291 (*holo:* PERTH; *iso:* CANB, K, MO, NSW).

Adult leaves 35–75 mm long, 7–18 mm wide. *Peduncles* 5–16 mm long. *Pedicels* 2–3 mm long. *Buds* 9–10 mm long, 3–4 mm diam.; operculum long-conical, smooth to very slightly ribbed, 5–7 mm long. *Fruit* globose to slightly cupular, smooth to very lightly ribbed, 6–10 mm long, 6–11 mm diam., operculum scar ascending, < 1 mm wide, disc level to ascending, 1–2.5 mm wide; valves 3. (Figure 2D)

Specimens examined. WESTERN AUSTRALIA: Mt Magog, Stirling Range, 6 Dec. 1994, *S. Barrett* 287 (PERTH); Ellen Peak, N slopes, 4 Oct. 1975, *J.S. Beard* 7655 (PERTH); road to Trio Peak, Stirling Range, 8 June 1969, *M.I.H. Brooker* 2325a (PERTH); Mt Trio car park, on track to hill, 14 Nov. 1981, *M.I.H. Brooker* 7183 (NSW, PERTH); S of Ellen Peak, Stirling Range, 7 Oct. 1982, *M.I.H. Brooker* 7705 (PERTH); half way up Mt Trio, N side, Stirling Range, 21 Mar. 1983, *M.I.H. Brooker* 8033 (PERTH); 15 miles [24 km] E of Red Gum Spring, Stirling Range, 17 Feb. 1969, *G.M. Chippendale* 434 (PERTH); Warrup Hill, Stirling Range, 28 April 1923, *C.A. Gardner s.n.* (PERTH); Stirling Range National Park, car park, Mt Trio road, 23 Mar. 1982, *S.D. Hopper* 2119 (PERTH); Stirling Range National Park, 4.5 km N along Success Ridge track from East Pillenorup track, 34°23'30" S, 118°10'50" E, 26 Mar. 1982, *S.D. Hopper* 2171 (PERTH); Stirling Range National Park, hill S of Yungemere, 5 May 1982, *S.D. Hopper* 2307 (PERTH); Stirling Range National Park, hill S of Yungemere, c. 0.8 km S of Yungemere Crescent fire trail, 5 May 1982, *S.D. Hopper* 2312 (PERTH); Bluff Knoll, 19 km ENE of Toolbrunup Peak, Stirling Range National Park, 6 May 1982, *S.D. Hopper* 2323 (PERTH); Stirling Range National Park, SE foothills, 7 May 1982, *S.D. Hopper* 2335 (PERTH); Stirling Range National Park, SE sector, foothills, 7 May 1982, *S.D. Hopper* 2337 (PERTH); Stirling Range National Park, c. 1 km N of summit of Wedge Hill, 9 May 1982, *S.D. Hopper* 2350 (PERTH);

summit of Wedge Hill, Stirling Range, 12 May 1982, *G.J. Keighery* 4880 (CANB, PERTH); base of Mt Talyuberup, Stirling Range, 14 May 1982, *G.J. Keighery* 4956 (CANB, PERTH); 50 m up walk track from Mt Trio car park, 10 Oct. 1987, *A. Napier & A. Taylor* 101 (ALB, PERTH); Mt Trio car park, Stirling Range National Park, 34°20'47"S, 118°06'38"E, 4 Nov. 2000, *D. Nicolle* 3560 & *M. French* (CANB, PERTH).

Distribution and habitat. Restricted to the Stirling Range, particularly the higher central and eastern part of the range, occurring on skeletal sandy loams overlying sandstones on the foothills, although also known to occur on the hills and ridges of the range itself. It occurs as a component of mallee shrubland, often associated with a number of other mallee species including *E. buprestium*, *E. decurva*, *E. falcata*, *E. hebetifolia* (syn. *E. medialis* and *E. xanthonema* subsp. *apposita*), *E. marginata* subsp. *marginata*, *E. megacarpa*, *E. preissiana* subsp. *preissiana* and *E. talyuberlup*.

Conservation status. Conservation Codes for Western Australian Flora: Priority Four. Although the total range of this subspecies is restricted, all the known populations occur within Stirling Range National Park and the subspecies is considered secure.

Etymology. The name is chosen because of the taxon's apparent restriction to the Stirling Range.

Notes. Distinguished from the typical subspecies by the shorter pedicels, the narrower buds with a long, conical operculum much longer than the hypanthium and the level to ascending disc of the fruit. Adult leaves, buds and fruits are also generally smaller in this subspecies.

Putative hybrids have been collected between *Eucalyptus ligulata* subsp. *stirlingica* and *E. buprestium*, *E. marginata* subsp. *marginata* and *E. preissiana* subsp. *preissiana*.

Acknowledgements

I wish to thank Malcolm French for field assistance and bringing to my attention some of the previously uncollected *Eucalyptus calcicola* subsp. *unita* populations. Steve Hopper provided information to locate the Bremer Bay population of *E. calcicola* subsp. *unita*. Ian Brooker is thanked for correcting the Latin diagnoses.

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